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AMERICAN INSTITUTE OF CHEMISTS

THE ROLE OF THE SCIENTIFIC SOCIETY IN CHEMISTRY

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THE CHEMIST IN THE PHARMACEUTICAL INDUSTRY

• • •

THE CHEMIST IN THE FIELD OF MODERN ILLUMINATION

• • •

THE YOUNG CHEMIST AND THE GOVERNMENT SERVICE

The CHEMIST

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TABLE OF CONTENTS

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The Role of the Scientific Society in Chemistry

By **Robert J. Moore**

***President,* The American Institute of Chemists**

THE beginnings of the modern association in science may be said to have arisen toward the end of the seventeenth Century. The Scholasticism and Humanism of the earlier periods created a caste of the learned, but when experimental science appeared in the wake of Bacon, Robert Boyle, and Descarte, the great democratization of knowledge began. Introducing experiment into science was the great contribution of the Seventeenth Century. Before that, in the words of Ornstein[1], "The respectable professors in the renowned seats of learning had no disposition to disfigure their academic gowns with splashes of acids, to fuss with childish devices in order to see how fast a ball would run down an inclined plane, or to be caught scooping up pond water covered with a disgusting scum. They had comfortable and long-revered works by ancient authorities which they could examine with dignity and expound to their classes without messing their pinafores, or distressing their gouty limbs".

Early in the Seventeenth Century, Sir Francis Bacon's *Advancement of Learning* and his *Novum Organum*[2] at one swift snip of the mental scissors seemed to cut the bonds that had held prisoner for centuries Man's innate spirit for research. His description of "Soloman's House" with its classification of research facilities, modern husbandry and its arts, telling of airplanes and submarines, and foretelling many of the inventions we today take pride in, is, to anyone interested in science, one of the most thrilling chapters in print. Recently the writer, visiting the U. S. Department of Agriculture building in Washington with its seemingly miles and miles of chemical laboratories, physical and electrical facilities, noiseless and unending libraries, and magnificent semi-plant scale equipment could not but be reminded of "Solomon's House". We today are also struck with Bacon's term of one group in his model world who "do nothing but collect the experiments which are in all books". These he calls the "depredators".

Both Robert Boyle and Descarte, following in the reasoning of Bacon, lifted experimental science and deductive reasoning from the mists of alchemy and medicine to a higher level where natural phenomena could

be investigated. Both were amateurs in the sense that Boyle[3] never used chemistry as a means of livelihood nor was ever connected with a university, while Descarte was neither an anatomist nor a physiologist. Both were amateurs, as were so many of the scientific men of succeeding generations, by the definition that an amateur "is one who is attached to or cultivates a particular pursuit, study or science from taste without pursuing it professionally". Yet Boyle is the foremost English scientist of his time while Descarte[4], elaborating the knowledge of his day to bolster his philosophic tenets, wrote *L'Homme*, regarded as the most famous textbook of physiology. It is imperative to name also in this group of amateurs, to whom science pays homage, the name of Huygens, never affiliated with any formal educational system, but responsible for the wave theory of light and the development of lenses, including the achromatic eye piece which bears his name. In his contributions to physical theory he ranks close to Newton.

Science, especially the natural sciences, has always progressed best where intellectual freedom was maintained, where free discourse and ready interchange of scientific views predominated. It is only in such an atmosphere of freedom for scientific inquiry that the "amateur", as defined above, may develop.

Birth of Scientific Societies

The impetus given to experimental research described above was further stimulated by the comparatively popular taste developed in England, France, Germany, Italy, and Holland for discourse and scientific argument. The natural outcome was the development during the latter half of the Seventeenth Century of more or less formal affiliations to carry out, describe, and discuss experimental work. "The rich and noble amateur devoted some of his wealth to gathering about him men who would jointly experiment and benefit by this collaboration. The professional scientist would become the center of those who joined him for instruction and whom he needed for assistance[5]".

The first of the scientific societies to appear for research and discussion was the Accademia de Cimento in Italy in 1657. About this time a group of ten or twelve men all "inquisitive in natural philosophy and especially in the new philosophy called Experimental Philosophy" were meeting in private rooms or college quarters in London. They were a diverse group of devotees of experimental science, scholars and amateurs; business men, divines, nobles, mathematicians and physicians. These meetings grew in attendance and their experimental work and

discussions soon attracted broader recognition. By 1662, the informal group was incorporated by Royal Charter as The Royal Society, which has held prestige ever since

In France, the Academie des Sciences was formally established in 1666. Germany, due to lagging in the development of its native tongue, still used Latin as the language for scientific discourse. It was not until 1677 that it established its Academia Natural Curiosorum.

Closely following on the establishment of these societies there appeared in one form or another their records or archives open to members for study and discussion. Above all else this is the life-blood of a growing science. And today, after two hundred and seventy years of perspective, the chief function of a Chemical society is the publication of the results of research.

The Chemical Societies in Great Britain and the Institute of Chemistry

Tracing the growth of the science of chemistry from the establishment of the Royal Society to the middle of the Nineteenth Century is one of our most absorbing stories. The names of the great chemists pass us in review with here a blazing light of an accepted theory, there a landmark in chemical synthesis, passing like "an army with banners". We come to the year 1841. Since early times the devotees of the science of chemistry had been philosophers, medical and legal men, scholars and researchers; it has frequently been the hobby of kings and emperors, popes and bishops. In 1841, it has become an organized group of facts and theories —the Science of Chemistry—and we have the founding in London of The Chemical Society.

With its growth during the middle of the last century, it became more widely realized that chemistry was of utmost practical utility in its application to health and to the arts and manufacture of the nations. It was realized by those who pursued chemistry that an organization was necessary to determine the course of study and to prescribe the qualifications and an ethical code for the practice of chemistry as a livelihood[6].

The Chemical Society in the sixties discussed conditions of admission to the Society, some holding that its fellowship should confer a qualification to practice chemistry as a profession, while others maintained that the intention of its Royal Charter was that membership should be open to anyone interested in the science, provided that he secured the nominations necessary for his election.

About 1867, the idea was advanced that the Society should form within its own body a professional organization of practicing Fellows, a discussion which persisted nearly ten years.

With the continued growth of the professional aspects of chemistry it was Professor Edward Frankland who in 1872 drew attention to the increasing importance of chemistry in relation to the public welfare and pointed out how much to be desired was an Institute which would be to chemists what the Royal College of Physicians and Surgeons was to the medical profession, and the Inns of Court to the legal profession. With the Chemical Society loath to act on principle and unable to change by charter, the Institute of Chemistry was founded by Royal Charter in 1885, fifty-four years ago. The Chemical Society advanced the *science;* the Institute promoted the *profession.*

"The foundation of the Institute was not altogether a popular venture[7]. Not a few leading men of science held that it was derogatory to make chemistry a profession, and some chemists themselves felt that the establishment of the Institute was an attempt to form a kind of trade union which it is not now and never has been." There were many who felt that it was repugnant to give such recognition to a body which proposed to make a *profession* of a *science.* They did not wish to confuse scientific chemistry with the chemistry which led to the earning of a living. In fact, to quote the genial Professor Jocelyn Thorpe of London,

"The Chemists then were all so pure
They would not even say manure."

The membership of the Institute of Chemistry of Great Britain and Ireland in 1885, the charter year, was four hundred and thirty, not many, but it included the leading consultants, official chemists, professors and chemical advisors in the Kingdom. Fifty years later, in 1935, there were six thousand three hundred Fellows and Associates.

American Parallelism in Associations

The earliest American association for the promotion of science was the American Philosophical Society of Philadelphia. It was proposed by Benjamin Franklin in 1743 and organized in 1769. There followed a period of rather close coöperation with the experimental leaders in Great Britain. But the need for mutual study and discussion early led to the establishment of distinctly chemical societies although their members were definitely of medical leaning. Dr. H. C. Bolton[8] mentions the following: The Chemical Society of Philadelphia, founded 1792; The Columbian Chemical Society of Philadelphia, founded 1811, and the Delaware Chemical and Geological Society, organized in Delaware

County, New York State, in 1821. However, Dr. Bolton after a careful historical study concludes that the oldest undoubted Chemical Society was that founded in London in 1841.

During the Nineteenth Century, chemistry and chemical groups received marked impetus and there were numerous small societies, largely local in membership, carrying on. But a special event of importance to chemists was the celebration of "The Centennial of Chemistry" at Northumberland, Pennsylvania, on July 31 and August 1, 1874. For this meeting of seventy-seven chemists, presided over by Dr. Charles F. Chandler, led in 1876 to the formal establishment of the American Chemical Society. With its meetings and extensive publication program, it grew rapidly toward the close of the Century and has long been the largest and most important chemical society in the world.

It is interesting to note, however, that the American Chemical Society had to go through its dangerous formative years with many anxious hours on the part of its officers. By 1889, its membership, which had never exceeded three hundred and twenty, had fallen to two hundred. Dr. C. E. Munroe[9] points out that "Dissatisfaction was generally expressed and a movement was on foot to form another rival organization. A meeting was called to ascertain the causes, and the remedies, and all were urged to present their views. As a result, it was learned that the organization had come to be looked upon as a local New York Society with non-resident members having very little association with it". Following this consultation, the program of migratory meetings, by which the Society might be brought to its members, was established, and the formation of local sections stimulated.

The Charter and Membership Growth of the American Chemical Society

The American Chemical Society was chartered in New York State "for the advancement and encouragement of chemistry and by its meetings, reports, papers, discussions and publications to promote scientific interests and inquiry". Its phenomenal growth for fifty-five years to a membership of over eighteen thousand was effectively promoted by its refusal to build up restrictions. Up until as recently as 1936, its call for scientific coöperation was as follows: "Membership is open to any reputable person *interested in chemistry*. There is no initiation fee." Like the Chemical Society of London, it required merely the endorsement of two members. In thus inviting to membership and to the reading of its journals all those interested without restrictions it was fulfilling the

true spirit of the Scientific Society. It took under its spreading wings the "amateur" who was interested because he had a taste for natural philosophy and those having no formal vocation in chemistry. Its journals were read and its lectures heard by business men, physicists, engineers, whose paths lay in adjoining fields, and many interested in general educational work.

The Professional Institute

Duplicating the discussion that had taken place in the British Chemical Society in earlier years regarding a more distinctive professional group, there occurred frequently in the American Chemical Society meeting about 1918 to 1923 the subject of classification of its members into groups. There were some who wanted to look over all the members of the American Chemical Society, over eighteen thousand of them, all elected to membership on the same basis of "an interest in chemistry" in order to re-shuffle them and to classify them into professional and nonprofessional groups. The inability and the inadvisability of so doing were apparent to most chemists and the classification idea was definitely rejected by the Council of the American Chemical Society. A revision of its requirements for full membership, however, was made about 1935, calling for "an adequate collegiate training in chemistry or chemical engineering together with active engagement in some form of chemical work for at least three years".

This departure from the traditional freedom of the scientific societies in electing to fellowship the amateurs, the humanists, and all those others in bordering fields of science is of questionable value. Certainly without such restrictions from 1900 to 1935 the Chemical Society has prospered beyond the dreams of its founders. And there is the mute point of suddenly requiring a strictly professional background for new members when over eighteen thousand have been admitted merely on "an interest in chemistry". And further, there are those who point out that some of its most honored members, officers, and even medallists in some cases did not finish a college course (occasionally voluntarily), and some received their education and degrees in other sciences, such as mechanical engineering and physics. Beyond these possible criticisms of restricting and limiting membership is the more fundamental objection based upon the ever widening expanse of the field of chemistry. For the modern chemistry, with its X-radiation, infra-red absorption and Ramon spectra; with its growing tide of new developments in sub-atomic phenomena, is requiring more and more, not only the coöperation but the *active interest in chemistry* of the physicist and other affiliated groups of scientists.

The mathematician finds in the laws and reactions of chemistry some of the most lucid developments and illustrations of his complex equations. What a pity to limit his interest in the science of chemistry, and the interest of all other business and professional groups, by building up restrictions which the history of fifty years had shown unnecessary.

During the early 1920's, the need for the professional group, however, following the arguments and requirements of the earlier movement in London in 1872, was apparent. In 1923, therefore, some four hundred chemists, members of the American Chemical Society, organized and incorporated THE AMERICAN INSTITUTE OF CHEMISTS, following closely the organization of the Institute of Chemistry in Great Britain and Ireland and the Canadian Institute of Chemistry. The professional term "chemist" was rigidly defined, with adequate training and experience in practice required for Fellow of the INSTITUTE. In addition to strict rules for professional conduct in its code of ethics, the INSTITUTE deals with all subjects affecting the professional status of the chemist, including questions of contracts, legislation and patents, state laws for professional licensing of those dealing with the public, and the maintenance of adequate professional morale through aid to the unemployed chemist. It is not the purpose of this paper to deal with all the activities of the INSTITUTE. It is not a scientific society for the promotion of chemistry. That is the scope of the American Chemical Society. And as shown above, the science has progressed so far and is moving ahead so rapidly that there is hardly time, at its semi-annual and local meetings, for listening to the papers, much less for adequate discussion of the new reactions, new apparatus, and new theories. The scientific interests of the Society are so vast and so fundamental that none of its time should be squandered on the questions of professional interest affecting but a small percentage of its membership.

THE AMERICAN INSTITUTE OF CHEMISTS on the other hand, organized and maintained especially for and by professional chemists, finds that this field is a natural scope. THE AMERICAN INSTITUTE OF CHEMISTS is the watch dog of the professional interests of the chemist. It has grown steadily and deliberately to a membership of fifteen hundred. By the coöperation of these two societies which complement one another, one for the advancement of the science, the other for the welfare of the profession, American chemistry moves forward to the better advantage of mankind.

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National Council Meeting

The next meeting of the National Council of THE AMERICAN INSTITUTE OF CHEMISTS will be held on Tuesday, November 21, 1939, at The Chemists' Club, 52 East 41st Street, New York, N. Y.

Chemical Exposition

THE AMERICAN INSTITUTE OF CHEMISTS cordially invites all members to register at its booth at The Seventeenth Exposition of Chemical Industries to be held in Grand Central Palace, New York, N. Y., during the week of December fourth. Members who request them may obtain admission cards to the Exposition from the Secretary's office.

New York Chapter Meeting

An informal dinner in honor of President Moore will be held on November 3, 1939, at The Chemists' Club, New York, N. Y. as announced elsewhere in this issue. Brief talks will be given by Dr. M. T. Bogert, Dr. Robert Calvert, Dr. Gustav Egloff, Dr. W. T. Read, Dr. F. D. Snell, Dr. Maximilian Toch, and by Dr. Moore.

The Chemist in the Pharmaceutical Industry

By Joseph Ebert

The President of The Ferastan Company, Philadelphia, discusses the work of the chemist in this industry.

WHAT is pharmaceutical chemistry? It is that branch of chemistry that is engaged in the development of natural and synthetic products for the diagnosis or the cure or the prevention or the mitigation of human and animal ills. It can be said that pharmaceutical chemistry is as old as the human race. Students of the Bible recall that the Good Book, in a number of passages, mentions pharmaceutical terms in relation to the treatment of ills. In the study of Assyrian, Greek, and Roman history, we find references to the use of chemical substances, in most cases of vegetable, in others of mineral origin, in the treatment of disease. In the middle ages some of the remedies, which even today play an important part in medicine, were known and quite widely used.

For instance, during the Thirty Year War, cinchona bark, the bearer of the quinine alkaloids, was employed in the prevention and treatment of malarial fever. It is stated that a supply of this bark was a part of the ration of each soldier. In 1630, Francisco Lopez de Canizares, Administrator of the Province Loxa in Peru, was cured from malaria with cinchona bark, which, it is said, had been prescribed by a Jesuit priest.

The materials used in pharmaceutical chemistry may be members of the vegetable, the animal or the mineral kingdom, or else they may be synthetically made. Up to the arrival of the synthetic era in chemistry, pharmacy and medicine depended entirely on the first three classifications. We all know that members of the botanical family, such as the already mentioned cinchona bark, cascara bark, rhubarb root, peppermint leaves, absinthe leaves, gentian root, squill, camphor, and an army of other barks, roots, flowers, herbs, gums, etc., have been made and are still being made into tinctures, fluid extracts, elixirs, pills, pastes, liniments or ointments or what else have you. Some of our best known so-called patent medicines, Fletcher's Castoria, Lydia E. Pinkham's Compound, etc., are examples of this class; or else, various

members of the vegetable kingdom served as the starting materials for a number of alkaloids, such as opium, the dried juice of the *Papaver somniferum* for the making of morphine, codein, or the cinchona bark for the alkaloids of the quinine family, the chocolate bean for theobromine, coffee beans and tea leaves for caffeine, digitalis for the glucosides, digitalin, digitonin, digitoxin, etc.

The animal kingdom supplies many of the fats and oils widely used, externally as well as internally, in pharmacy and medicine. Adeps or lard has served for centuries as the base or the carrier of medicaments in ointments. Lanolin (or wool fat), the purified fat of sheep wool, serves the same purpose. Fats or greases from various animals, such as the fox, the dog, the goose, etc., have been employed, externally and internally, for a number of diseases ranging from the treatment of a boil to that of tuberculosis. In many sections they are still important "folk remedies". We all remember when in our childhood Mother used to force a teaspoonful of cod liver oil down our rebellious throat. In those days this important product of the fresh livers of the *Gadus morrhua* was given for general, mostly undetermined, principles. Today we take it, in concentrated form, in a palatable tablet for its vitamin content. Liver extract for anemia and insulin for diabetes are other important members of this family. For the past few years, vitamins, hormones and glandular products have become the most conspicuous products derived from the animal kingdom.

We are all aware of the many compounds that the mineral kingdom has furnished to pharmaceutical and medicinal chemistry. There is hardly an element in the periodic system that has not been used for medicinal purposes. Chlorine, bromine and iodine, in inorganic and organic combination, are highly important; iron, in metallic form (as reduced iron) as well as in the form of many inorganic and organic compounds, is still the old standby in anemic conditions or as a general tonic. In recent years copper has been given in conjunction with iron, since at the University of Wisconsin it was found that small amounts of copper had a catalytic effect on the absorption of iron. Bismuth compounds are widely used, internally for intestinal disorders or externally for the treatment of some skin afflictions. For the past ten years bismuth salts have also been employed in the treatment of syphilis. Arsenic and mercury are reputed to be the oldest members of the mineral family, having been used medically in Old Egypt and Rome. We all know of their importance in pharmaceutical chemistry today; arsenic being a constituent of arsphenamine and mercury being used in

many forms, externally as well as internally. Calcium, magnesium, and aluminum salts are used in ton lots every year for pharmaceutical purposes, ranging from their use in toothpowder or toothpaste to the treatment of gastric hyperacidity and stomach ulcer.

While I have treated the vegetable, animal, and mineral kingdoms as independent supply sources for pharmaceutical and medicinal chemistry, they are actually closely interwoven with the field of synthetic chemistry, insofar as many of these products are serving as starting materials or intermediates in the synthetic field. This field, undoubtedly, is today the most important branch of pharmaceutical chemistry. It can be safely stated that the beginning of synthetic pharmaceutical chemistry dates back to the year, 1874, when Kolbe, in Germany, gave us a synthetic process for the manufacture of salicylic acid. As long as we consider the synthesis of salicylic acid as the threshold of synthetic pharmaceutical chemistry, let us hear the story preceding the year 1874.

In 1834, salicylaldehyde (the so-called salicylous acid) was discovered by Pagenstecher in the flowers of *Spirea Ulmaria*, a shrub cultivated for its handsome flowers (*rosaceae*). In 1837 it was found that oxidizing agents would convert this aldehyde into salicylic acid. However, in 1843, Procter discovered that the acid could be made from oil of wintergreen, which contains more than 95 per cent of methyl salicylate. This compound was treated with potassium hydroxide and the potassium salicylate was obtained. This salt was used for a number of years in all indications in which today sodium salicylate is employed. However, this potassium salicylate being rather expensive, the use of salicylates did not become general until Kolbe, in 1874, made salicylic acid available synthetically. The importance of salicylic acid and its derivatives in medicine is too well known to elaborate upon.

In surveying the field of synthetic pharmaceutical chemistry from the year 1874 on, we cannot help being impressed by the fact that from then on until the earlier part of this century the chemist concentrated his efforts on the development of analgesics. This, no doubt, was chiefly due to the fact that the biological functions of the body were then comparatively little explored and that, therefore, the chemist, instead of striking at the cause of the disease, was satisfied to eliminate the pain, prompted by the thesis of the medical men of the eighteenth century: "rid the patient from pain, and nature and the doctor will be much better able to cure the patient".

Many derivatives of salicylic acid were created, most of them were discarded and forgotten until in 1899 aspirin (acetyl salicylic acid) was

born. The importance and popularity of this compound is borne out by the fact that its consumption in this country in 1937 (the latest statistics available) amounted to approximately three and one-third million pounds. This is a big figure for any pharmaceutical compound. Converted into five grain tablets, this would yield approximately 4,950,000,000 tablets and this converted into boxes of twelve tablets each would give 412,500,000 boxes; or figured in terms of the population of this country, 120,000,000 people, each inhabitant would have taken forty-one tablets, each five grain, of aspirin in 1937. There are no figures available as to how many of these tablets were consumed by the business men of this country who have had reputedly one headache after another for several years.

Between the discovery of salicylic acid in 1874 and of aspirin in 1899, two independent series of analgesics were developed. One series, derived from aniline, is represented by acetanilide (1885) and phenacetin (acetphenetidine) in 1887. Both are still widely used; acetanilide is a constituent of Bromo-Seltzer, the well known remedy for "the morning after". The other series, derivatives of pyrazolone, is represented by antipyrine (1884) and amidopyrine, a little later. Both compounds have been quite popular with the medical profession, until recently when they were found to cause, in certain cases, an undesirable and dangerous change in the blood picture, agranulocytosis and leukopenia. Another series, members of the quinoline family, is led by atophan (or cinchophen) which was introduced into medicine in 1910 and which, together with some derivatives, has established quite a reputation as an analgesic in certain types of arthritis and also in gouty conditions due to its effect on the excretion of urates.

The most important pharmaceutical products synthesized in the earlier part of this century (in 1905) is the veronal or barbital family and Salvarsan (arsphenamine) by Ehrlich in 1906. The barbitals belong to the class of soporifics or sleep producers. In this series phenobarbital is particularly well known.

The discovery of salvarsan by Ehrlich, as you all know, has been considered a milestone in chemotherapy since, together with its congener, neo-salvarsan, it has proven to be the long looked for specific treatment in spirochetic or syphilitic conditions. The excitement and the enthusiasm caused by the discovery of salvarsan has not been duplicated until 1937 when sulfanilamide, the specific for streptococcus infections, had its first clinical trial in this country, to be followed in 1938 by sulfapyridine, the specific for pneumococcus infections.

Another important development of the earlier part of this century was novocain or procain (in 1908), the local anesthetic so well known to everybody from his visits to the dentist.

While up to 1914, the beginning of the World War, the Germans and the French were looked upon as the pioneers in synthetic pharmaceutical chemistry, the beginning of the war with its suddenly interrupted importation served as a stimulus to the American chemist to attack the synthesis of pharmaceuticals. Soon laboratories and factories in this country were able to furnish to the medical profession and to the suffering public the needed compounds. Today, a little more than twenty years after the conclusion of the war, our pharmaceutical industry is not only independent of foreign imports but we are also exporting substantial quantities to practically every corner of the earth. Millions of dollars are being invested in pharmaceutical manufacturing and millions of dollars are being spent every year in research for the improvement of old and the development of new products. As a result, many important and new compounds have been evolved in practically every line of medicinal chemistry, such as new barbituric acid derivatives of superior therapeutic action, new antiseptics, namely metaphen, merthiolate, mercurochrome, new pressor agents, new local anesthetics, vitamin preparations, etc.

However, much work is yet to be done. Research in pharmaceutical chemistry cannot afford to let down. The medical profession and the public are looking to the research mind of the chemist for the solution of many, many problems; will the chemist find a cure for cancer, for tuberculosis, for arthritis, just to name only a few of the most pressing problems? Will the chemist find the ideal internal antiseptic, the ideal agent for regulation of blood pressure and circulation? The field of vitamins, hormones and glandular products has to be further explored, and so on. The opportunities for the research man, and, of course, later on for the production man, in pharmaceutical chemistry are tremendous. What are the ideal requirements for a pharmaceutical chemist? He should have a thorough knowledge of inorganic and particularly organic chemistry. In order to enable him to select his research program intelligently, he should have a good conception of the pharmacology of chemical compounds and individual groups and radicals. He should acquaint himself with the biological functions of human and animal life. He must, at all times, be willing to coöperate with the pharmacologist, the pathologist and the clinician because without their assistance his work could never lead to any feasible and practical results.

If the work of the pharmaceutical research man were completed with the synthesis of a new compound, everything would be nice and rosy. However, this work is only the first milestone to success or failure. After he has convinced himself, by painstaking chemical and physical methods, of the identity and the purity of his new compound, the pharmacological laboratory enters into the picture. There the toxicity of the compound is to be determined on mice or rats or both, oftentimes larger animals have to be employed; the minimum lethal dose will be established and on the basis of this a safe dosage for men will be calculated. The histologist and pathologist will examine the vital organs of the autopsied animals to find out whether or not some damage was caused by the compound. In some cases, the animal work will throw some preliminary light on the therapeutic action of the compound. Hundreds of animals and oftentimes more have to be studied to enable the pharmacologist and pathologist to draw some definite conclusions as to the absence of toxicity and the safety of the compound for men.

Only then is the new chemical ready for the clinician for his experimental work on human beings. Outside of his study of the therapeutic effect, he will carefully observe the occurrence of side reactions, such as the effect on the stomach, etc. Only after several hundred cases, the more the better, have been studied, preferably by several independent investigators, are you in a position to arrive at a definite judgment as to the therapeutic value and to the safety of your new development. Quite naturally, the animal and clinical work in many instances leads to considerable headaches and heartaches. A compound, which from its chemical structure may look highly promising, may prove in its tests on animals too toxic for human consumption and a compound, which has shown up very encouragingly in the animal work, may in the human work, not show the therapeutic effect expected, which automatically means that perhaps months and months of chemical laboratory work have been nullified. It is exactly this point that makes pharmaceutical development work a rather hazardous and expensive proposition. I have seen instances where a new compound was developed in the laboratory in two or three months but during the animal and clinical work so many complications turned up that this phase of work could not be concluded before a year or more. On the other hand, it took a chemist, to develop a certain product in the laboratory, two years and in about three weeks of animal study the inadvisability of proceeding with the work for a number of well founded reasons became apparent.

However, in spite of all the adversities and disappointments con-

nected with his work, the pharmaceutical chemist must educate himself to be an idealist; he must always keep in mind that the medical profession and the public look to him for the weapons to successfully combat disease and cure ills. He should pursue his work with the same zeal and idealism as many great chemists and pharmacologists in the history of chemistry and medicine did before him, such as Ehrlich, Barger, Banting, Abel, and others.

The Chemist in the Field of Modern Illumination

By Robert Mackey, A.A.I.C.

ARTIFICIAL light has through the ages experienced a slow constant evolution. A mighty chronicle could be written of its development from the camp fire and torch to the incandescent lamp and luminous tube of the present day.

The achievements of modern lighting belong to the chemist, as much as to any other professional, and further advances seem unlikely, without the aid of chemical research.

Present lighting mediums might be divided into two types or sources, namely, the incandescent lamp, and the gaseous discharge tube. Each has definite use and advantage in its particular field, and by the same token each has a host of problems which when solved will further the efficiency of these tools of mankind.

In America, the work of Edison in the development of the incandescent lamp will always be considered an outstanding achievement. The effort to find suitable glass globes, filaments, and coatings has made scientific history. This work still goes on. Vacuum processing, and new materials for increased life and efficiency are still being developed and perfected. It is interesting to note that the incandescent lamp was responsible for the development of the modern vacuum electron tube which is so basic to modern radio and other electronic devices. The Edison effect is a name given to the continuous flow of electronic current, which was first noticed by Edison in his work, and later developed by such men of science as Fleming of England, and De Forest of the United States, into such unlimited possibilities.

Although the commercial development of the electronic lamp, or

gaseous discharge tube is of rather recent origin, the principle of its operation has been known for many years. Geissler of Bonn presented tubes bearing his name in 1838, which were the forerunners of modern discharge tubes.

The discovery of the rare gasses by Sir William Ramsey, and the later work of the Frenchman Georges Claude, made possible the commercial use of such tubes and revolutionized the advertising industry's lighting.

The Neon and similar gas lights, due to their particular form of light and methods of operation, have not been practical for ordinary lumination although many adaptations of them are coming into use. Discharge tubes probably approach nearer to the sought after cold light than any other luminous medium at present in use. In fact many authorities believe the lighting of the future will be of this type.

In the past few years another light source of no small promise has been adapted to the discharge tube namely, the phenomenon of fluorescence.

Many minerals and chemical compounds have the property of emitting light when stimulated by some outside source. This particular phenomenon is known as fluorescence, as certain fluorites were the first minerals observed to possess these characteristics.

The mineral fluorites were slightly heated to stimulate or excite them, a reaction now called thermo-luminescence. More recent work has proven that such excitation can be produced by ultra-violet, cathode, X-rays, and by the aid of radio active substances. When a light glow persists after the excitation principle is removed, the phenomenon is known as phosphorescence. Where only friction such as rubbing or scratching causes the flash it is termed tribo luminescence.

Modern investigators however, now call such mineral-emitted light, luminescence, which in turn is divided into various catagories, as photo, cathode, thermo, tribo, etc. Such phenomena may best be understood when one realizes that light is one of many forms of energy that is given off as waves or often referred to as radiated energy. The better known wave types are listed as follows:

TYPE OF WAVE	LENGTH IN METERS
Cosmic	$.04 \times 10^{-12}$ to $.067 \times 10^{-12}$
Radium	5.6×10^{-12} to 1×10^{-11}
X-ray	10^{-11} to 4.5×10^{-9}
Ultra-violet	$.01 \times 10^{-6}$ to $.4 \times 10^{-6}$
Visible Light	$.4 \times 10^{-6}$ to $.77 \times 10^{-6}$
Heat Infra Red	$.77 \times 10^{-6}$ to 3×10^{-4}
Radio	1 to 3×10^{4}

All these waves travel through space at the same velocity, about 186,000

miles per second. All radiate from some source of vibrating particles and the faster the vibration the shorter are the wave lengths. The term cycles is now used in referring to rate of vibration, and the rate of vibration is equal to the velocity divided by the wave length.

In considering fluorescence in these terms, we realize the mineral or salt receives the short invisible ultra-violet rays and converts them into the longer waves of the visible spectrum. A fluorescent mineral emits visible light from some vibrating particle within the mineral, which in turn has received energy from a source of ultra-violet light which has caused the vibration. Just what the nature of the substance within the mineral may be is not definitely established. Some slight chemical impurity or structural difference will cause a fluorescence or absence of fluorescence.

Such minerals as Willemite and Kunzite are known to have fluorescent powers. They in turn may be produced synthetically by carefully balanced formulas and exact heat treatments. In fact luminescent compounds developed in the laboratory are said to have shown greater light power and uniformity than the natural minerals.

The phenomenon of luminescence, like many other of nature's peculiarities, has become a useful tool to society. The Fluoroscope has been a great boon to the surgeons; and with the X-rays, bone structure, etc., are exposed to the eye.

Paints made from fluorescing substances are used by the theatrical world to produce spectacular effects. In the laboratory, minute traces of materials can be detected by fluorescence. Society has been protected, as documents and paintings have been proven forgeries because materials used in their manufacture differed under such a light source.

The cathode ray tube has become a tool of no little importance to the engineer and physicist in the field of radio and television. It will become of greater importance as time goes on. In the luminous tube industry, fluorescent minerals have added a new source of possible lighting effects; for example the zinc ortho sulphide brilliant green fluorescence is now very evident. This effect is produced by coating the walls of the glass tubing with the fluorescing chemical which has been ground to a fine powder and incorporated into a suitable binder such as potassium silicate. These translucent tubes are exhausted and charged with argon or a noble gas mixture, which when excited gives off quantities of ultraviolet light. This is further aided by the addition of small amounts of mercury which increases the production of necessary light stimulus.

The pleasing effects of this type of lighting and the various colors

made possible should create many more uses for luminous tubes in advertising and lighting in general.

In the conversion of light by fluorescence, individual protons are absorbed by the molecules of the fluorescing salts. However, there is always some energy dissipated so the energy of reradiated light per proton is less than that of the incident light, but production of colors of greater visibility by luminescence more than offset this energy loss.

In conclusion, the electronic field has many problems for the research worker that should prove fruitful. Many new metals and alloys can better the present day filament and electrodes. Rare gas combinations and such possibilities as the effects of the alkaline earth metals on breakdown voltages may be developed to more general use. The production and development of fluorescing compounds give promise of unlimited lighting colors and uses. These few problems are but part of a large number which when solved will increase the efficiency of tomorrow's lighting as well as further the entire field of electronics.

The Young Chemist and the Government Service

By Louis Marshall, F.A.I.C.

The seventh of a series of articles dealing with opportunities for the chemist in the Government Service.

Bureau of Dairy Industry

ANOTHER important subdivision of the Department of Agriculture is the Bureau of Dairy Industry. In general, its functions are to increase the efficiency and economy of milk production, to better the quality of all other dairy products, and to develop new uses for all the by-products of the dairy industry. To assist in this work, the Bureau maintains a herd of about three hundred dairy animals in its experimental farm at Beltsville, Maryland. The chemical research work of this bureau is centered in the Division of Dairy Research. Its past investigations have demonstrated that an adequate supply of carotene in the ration of the cow is absolutely essential for maintenance of the milk flow, and for normal reproductive functions. Carotene is a hydrocarbon which has the empirical formula $C_{40}H_{56}$. It is the substance

which gives the characteristic coloring to carrots and is closely related chemically to vitamin A, being readily converted into the latter by the liver.

The division is continuing its studies on the effects of certain physical agents on bacterial spores. It has been established that the sporicidal action of ultraviolet rays is not due to the hydrogen peroxide and ozone formed by the rays, but to some other cause as yet unknown. It has also been shown that the hydrogen ion concentration of the medium in which the spores are exposed does not influence markedly the sporicidal action of the ultra violet rays.

As stated before, one of the functions of the Bureau is the development of new uses for products of the dairy industry. To this end, researches have been conducted on the manufacture of thread fibers from casein. Fibers which show considerable promise from the standpoint of strength and elasticity have already been produced, and further investigations are being made in coöperation with certain manufacturers of synthetic fibers. Also, the utilization of whey in the production of lactic acid by fermentation has been studied. Another very fruitful field of research which is engaging the attention of the Bureau, is the production of synthetic plastics from the by-products of the dairy industry.

The Bureau is devoting a great deal of attention to improving methods used in the manufacture of cheese. The control of the highly complex processes involved in the production of Swiss cheese, for instance, is difficult because it involves the control of several species of bacteria causing each to function in its proper sequence so that normal ripening of the product will be assured. Workers at the Bureau have contributed several papers to the literature of Swiss cheese making. One of them, published in volume eighteen of the *Journal of Dairy Science*, dealt with the relation of the acidity of starters and of the pH of the interior of Swiss cheese to the quality of the cheese.

In order to assist producers of Swiss cheese in establishing proper control of their manufacturing processes, the Bureau has a staff of experts who travel around in automobiles which are fully equipped for chemical and bacteriological work. These experts furnish laboratory service to the Swiss cheese manufacturers by helping them to control their processes. The resulting improvement in the quality and uniformity of the product will no doubt convince many producers of the necessity of instituting proper laboratory control right in their plants.

In another laboratory of the Bureau, the relationship between the

acidity of cream used in the manufacture of butter, and the keeping quality of the butter was studied. This work has not yet been completed, but enough data has been obtained to show that as the acidity of the cream increased, the keeping quality of the butter decreased at an accelerating rate.

The Bureau of Dairy Industry has a section devoted to ice cream investigations. The ice cream industry in the United States is a very large one, and the processes involved in the manufacture of a good grade of cream are very complicated. In the trade it is known that a product which has a fine texture is more attractive and desirable than one which is coarse-grained. A study of the factors involved in the production of a fine textured cream led to the conclusion that the determining factors in the stability of ice cream mixes appear to be the condition and the extent of the presence of butterfat and gelatin, and also the length of freezing time. These conclusions, based upon experimental evidence, are utilized by ice cream manufacturers with a resultant improvement in the economy of production and quality of the product. A study of the highly complex colloid known as ice cream requires the methods of physical and colloid chemistry. One of the recent publications on this topic appeared in volume forty of the *Journal of Physical Chemistry*, and dealt with the viscosity relationships in emulsions containing milk fat.

The cleaning of apparatus and utensils used in the dairy industry is usually done by an antiseptic compound or mixture capable of giving off chlorine gas. Chloramin-T is such a compound, and is widely used for the purpose. A solution of chloramin-T was found to be more stable, both in open and in closed containers, than a mixture of calcium hypochlorite which is also used for cleaning purposes. Further studies are continuing on chloramin-T to determine the extent to which it attacks metals used in the dairy industry such as tin, aluminum, copper, bronze, and monel metal.

The professional staff of the Bureau of Dairy Industry comprises specialists in the fields of bacteriology, physiology, dairy husbandry, dairy manufacturing, and chemistry. The chemists total twenty-two and are distributed among the grades as follows: Four senior chemists, one chemist, two associate chemists, thirteen assistant chemists, and two junior chemists. In addition, there is a staff of employees doing work of an auxiliary type, who hold ratings in the various grades of the subprofessional service.

The Bureau of Home Economics

The Bureau of Home Economics, another subdivision of the Department of Agriculture, is a stronghold of the woman chemist. In general, its functions are to investigate the utility of agricultural products for food, clothing, and other home uses. Its researches, while very scientific, are presented to the public in such form as to make the results understandable to the ordinary housewife. The work is highly diversified dealing with such topics as home dyeing, with natural dyes; home canning of fruits, vegetables, and meats; the cooking quality, palatibility and carbohydrate composition of potatoes as influenced by storage temperature; quality guides in buying women's cloth coats; physical and chemical properties of some Turkish towels and so on. The results of the researches on these subjects are presented not only in scientific journals, but also by utilizing the radio, press releases, motion pictures and exhibits of different kinds. The Bureau gets out a weekly press release, the "Market Basket", which is published in some newspapers. It deals with such topics as meal planning, nutrition, and also gives advice on food selection, which advice is based on market conditions existing at the time. Many radio talks, such as the weekly one on the National Farm and Home Hour, are given by members of the staff. These radio lectures have become very popular because of the practical suggestions contained in them.

One of the divisions of the Bureau of Home Economics deals with food and nutrition. Recently, it has undertaken a study of the mineral content of different foods. Existing data on this subject are not very complete, and further information will doubtless be of value to investigators in the field of nutrition. Preliminary results of this work indicate that soybeans, for instance, are a good source of iron and calcium in the diet. One of the phases of the investigation will be an attempt to determine the influence that a particular soil treatment has on the mineral content of the crops of that soil. This is a problem of considerable importance and has not as yet been studied.

Researches into the vitamin content of foods is another important part of the duties of the division. Assays of the vitamin C content of orange juice and tomato juice have shown the former to be about three times richer than the latter in this respect. Many determinations were made of the vitamin A, B, and G content of different kinds of nuts. Pecans were found to be a good source of vitamin A, while almonds were only a poor to fair source. Almonds, however, as well as English walnuts,

filberts, Brazil nuts, peanuts, and pecans have been found to be rich in vitamin B.

Another problem engaging the attention of the Division is the determination of the significance which the metal vanadium may have in nutrition. Experimental diets will be prepared in which the absence of vanadium, as determined by spectrum analysis, will be assured. The Bureau of Home Economics, like the Bureau of Chemistry and Soils, is interested in the selenium problem as it affects nutrition. One of its publications, "The Toxicity of Foods containing Selenium as shown by its Effects on the Rat", appeared as *Technical Bulletin* 534 of the Department of Agriculture. Another contribution to the selenium problem dealt with the inhibiting effect of sulphur in selenized soil on the toxicity of wheat to rats. It appeared in volume fifty-two of the *Journal of Agricultural Research*.

The problem of food utilization is an important one from the standpoint of the thrifty housewife, and the workers of the Bureau have not neglected it. An inquiry into the waste involved in the preparation of vegetables for cooking led to some interesting results. Some common vegetables which have a waste of less than ten per cent in preparation for cooking are tomatoes, young carrots, onions, and snap beans. Those having a waste of less than twenty per cent include turnips, potatoes, cabbage, sweet potatoes, cauliflower, and egg plant. Vegetables which grow in pods, like peas and lima beans, lose about sixty per cent. Corn shows the greatest waste in preparation for cooking, seventy-five per cent. Spinach, unfortunately for children, has a waste of only twenty per cent. As part of this work, the amount of heat required for cooking vegetables when the source was gas, was compared with that required when the source was electricity.

The Bureau is coöperating with the Bureau of Dairy Industry by enlightening the public regarding the advantages of dried skim milk. This item in the diet is especially suited to the needs of low-income groups, and an appreciation of its nutrient value will probably lead to its acceptance even by those of higher income. The addition of dried skim milk to the diet will definitely prevent pellagra and one of the reasons motivating the Government in distributing this product to families on relief is the prevention of this deficiency disease. As an aid to the housewife in her problem of choosing adequate and palatable diets at prices she can afford, the Bureau has prepared a bulletin, "Diets to

Fit the Family Income". It can be obtained by writing to the Bureau of Home Economics, Washington, D. C.

Another division of the Bureau deals with textiles and clothing. One of its problems is to determine the nature and the rate of the deterioration of textile fabrics. A method was devised for measuring wool damage due to the scale breakage of the wool fibers. By this procedure, it is possible to determine the extent of the damage to wool fibers or fabrics caused by each step in the manufacturing process. Recent studies of the division regarding cotton fabrics have dealt with the stiffness produced on the fabrics by various starches.

The Bureau of Home Economics coöperates with the Extension Service of the Department of Agriculture in promoting the use of natural dyes in rural communities. The work involves practical demonstrations on the use of natural dyes at agricultural exhibits and at various conferences with Federal and county farm agents. One result of this work has been the cultivation in many states of the madder plant which is the source of a very fine natural dye. The textile and clothing division is determining the dyeing properties of an exotic plant obtained from South America with a view to deciding whether its cultivation in this country would be worth while. Miscellaneous publication two hundred and thirty, of the Department of Agriculture, deals with home dyeing with natural dyes, and is a contribution of the textile and clothing division.

An important and highly practical part of its work is the preparation of understandable leaflets and photographs which guide the consumer in purchasing those textile materials best suited for her needs and her family's needs. The photographs have been made into folios, and are loaned to women's clubs throughout the country. They have become very popular, and are in constant demand since they deal with such practical subjects as the buying of hosiery, wash dresses, women's coats, towels, etc.

The Bureau of Home Economics, in carrying out its diversified activities, utilizes the services of food specialists, clothing specialists, scientific aides, one physicist, and the following chemists: Two senior chemists, three associate chemists, three assistant chemists, and three junior chemists. Its modest expenditure of $180,000.00 for one fiscal year brought more than ample returns by pointing the way to a healthful, scientific, and economical management of the American household.

COUNCIL

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Vice-President, J. W. E. Harrisson
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Gerald Wendt

CHAPTER REPRESENTATIVES

New York	*Niagara*	*Philadelphia*	*Washington*
Charles A. Marlies	A. W. Burwell	Gilbert E. Seil	Albin H. Warth

October Meeting

The one hundred and sixty-fourth meeting of the Council of The American Institute of Chemists was held in The Chemists' Club, 52 East 41st Street, New York, N. Y., at 6:30 p. m., on October 10, 1939.

President Robert J. Moore presided. The following officers and councilors were present: Messrs. R. A. Baker, J. W. E. Harrisson, H. G. Knight, C. A. Marlies, R. J. Moore, H. S. Neiman, W. T. Read, G. E. Seil, F. D. Snell, M. Toch, and L. Van Doren. Mr. M. R. Bhagwat and Miss V. F. Kimball were present.

The minutes of the preceding meeting were read and approved.

In the absence of the Treasurer, the Secretary read the Treasurer's report, showing cash on hand as of September 30, 1939, of $4113.51, with bills payable of $20.24.

The Secretary reported that the Institute membership now numbers 1490.

Dr. Joseph W. E. Harrisson reported for the Committee on Licensing. Dr. F. D. Snell reported on the progress of the Committee on the Proposed Amendment to the Education Law of the State of New York.

Upon motion made and seconded, the action taken at the May 23rd meeting of the Council in substituting "licensed chemist" for "professional chemist" in the proposed licensing bill was rescinded, and the licensing bill will be presented with the words "professional chemist" reinserted.

Dr. Gilbert E. Seil reported progress for the Committee on Patents.

The recommendations of the Washington Chapter for Civil Service revision were discussed, and the Washington Chapter was asked to reconsider item 2 and 3 of those recommendations;

to discuss the matter with Dr. Henry G. Knight; and to submit the final draft of their recommendations to the Council for submission to the Civil Service Commission.

Upon motion made and seconded, the following Fellows were elected to paid-up life membership: Horace G. Byers, Herbert R. Moody, and E. Emmet Reid.

Dr. Read reported progress for the Committee on Membership and his suggestions for continuing the work of the Committee were approved.

Upon motion made and seconded, a vote of thanks was given to the membership committee for its excellent work.

The following new members were elected:

FELLOWS

Forbes, John C.
(1939), *Associate Professor of Biochemistry*, Medical College of Virginia, Richmond, Virginia.

Froelicher, Victor
(1939), *Chemist in charge of Auxiliary Products*, Geigy Company, Inc., New York, N. Y.

Stein, Harold J.
(1939), *Consultant Biochemist*, 615 N. Wolfe Street, Baltimore, Md.

Stewart, Jeffrey R.
(1939), *Editor and Publisher*, National Paint Bulletin, Washington, D. C.

JUNIORS

Kuti, Albert J.
(J.1939), *Student*, University of Colorado, Boulder, Colorado.

Mark, Hubert J.
(J.1939), *Analyst*, E. A. Siebel and Company, 8 S. Dearborn Street, Chicago, Ill.

Upon motion made and seconded, Leo H. Crosson and Charles E. Entemann were raised from Juniors to Associates.

Invitations from the Washington and Pennsyvania Chapters to the INSTITUTE to hold its 1940 meeting in Washington or Philadelphia were read and referred to a later meeting of the Council.

There being no further business, adjournment was taken.

—Howard S. Neiman, Secretary

CHAPTERS

New York

Chairman, Harry G. Lindwall *Vice-Chairman*, Beverly L. Clarke

Secretary-treasurer, D. H. Jackson
17 John Street
New York, N. Y.

Council Representative, Charles A. Marlies

The New York Chapter announces that an informal dinner in honor of our national president, Dr. Robert J. Moore, will be given Friday, November 3rd, 1939, at 7:00 P. M., at The Chemists' Club, 52 East 41st Street, New York, N. Y. This will be the first meeting of the season.

Niagara

Chairman, Maurice C. Taylor *Vice-chairman,* F. W. Koethen

Secretary-treasurer, Alvin F. Shepard
90 Courier Boulevard
Kenmore, N. Y.

News Reporter to THE CHEMIST, Margaret C. Swisher

Council Representative, Arthur W. Burwell

Carl H. Rasch, *Alternate*

Pennsylvania

Chairman, Walter L. Obold *Vice-chairman,* A. C. Angus

Secretary-treasurer, Harry C. Winter
The Biochemical Research Foundation
133 South 36th Street
Philadelphia, Penna.

Council Representative, Gilbert E. Seil

News Reporter to THE CHEMIST, Kenneth A. Shull

Washington

President, Frank O. Lundstrom

Vice-president, Albin H. Warth *Treasurer,* Philip A. Wright

Secretary, Martin Leatherman
9 Quincy Avenue, Hyattsville, Md.

News Reporter to THE CHEMIST, Edward F. Snyder

Council Representative, Albin H. Warth

Executive Committee

J. R. Adams	H. C. Fuller	N. W. Matthews	W. H. Ross
M. S. Anderson	L. R. Heiss	J. W. McBurney	E. F. Snyder
A. P. Bradshaw	J. H. Hibben	A. L. Mehring	J. J. Stubbs
R. T. K. Cornwell	B. Makower	R. M. Mehurin	E. K. Ventre
P. R. Dawson	L. N. Markwood	A. R. Merz	C. W. Whittaker
R. B. Deemer			J. F. Williams

A special meeting of the Washington Chapter was held July 12, 1939, at Wardman Park Hotel, with President F. O. Lundstrom presiding. The main business of the evening had to do with the report of the Civil Service Improvement Committee which was made by Mr. McBurney. This report was taken up by sections for discussion, amendment and adoption. President Lundstrom called attention to the fact that the program for the coming year must be made broad enough to interest all members in and out of the Civil Service.

NORTHERN LIGHTS

By Howard W. Post, F.A.I.C.

A very interesting paper on chemical engineering education by Professor J. Watson Bain of the University of Toronto appears in *Canadian Chemistry and Process Industries* **23** 333 (1939). Dr. Bain notes, among other points, a trend which we see all around us in this country as well, that is the pushing of more and more factual material down from the senior college to junior, from freshman college year to the secondary school level, etc. He sees as a result of this situation an enforced choice of a career at a lower age than formerly. He points out the rising costs of scientific laboratory equipment and wonders just to what extent the taxpayer will be willing to foot the bills for such additional outlays on behalf of secondary schools. The statement is made that universities cannot look to the secondary schools for much coöperation in raising the standards for admission. If there is little hope for a further tightening up of secondary school curricula in experimental science, there is another possibility, namely that of lengthening the chemical engineering curricula to five years to crowd in the amount of knowledge that could otherwise be imparted, if some of the more elementary material could be given in high school. In many colleges in the United States the course is now drawn up to include one or two summer courses, making the equivalent of four years and a half and perhaps many of these will eventually require five. This may be the answer to the problem created by the enormous and swift increase in the sum total of scientific factual material in our age.

The subject was continued on page 432 of the same volume under the heading, "Should Theories of Atomic Structure be Presented in High School Courses?"

An echo from the recent meeting of the Canadian Chemical Association at London, Ontario, last June was seen in a recent published report of the seminar on chemical unemployment. Dr. Elworthy who introduced the subject stated that as far as data at hand would seem to indicate, the average salary of a chemist in Canada is somewhat lower than that of his colleague in the United States. It was felt that unemployment was not caused so much by overproduction of chemists as by underselling. In other words a chemist who stressed what he could give his prospective employer stood a much better chance of getting a job than one who placed the emphasis on remuneration.

Positions Available

Ph.D. Inorganic chemist for gas research. $2400.

Young metallurgical engineer with some experience in mechanical and metal fields for sales work in brazing and welding metals. $2600.

Ph.D. Physical Chemist. Recent graduate. Interests in the field of oil temperature research. $2400.

Ph.D. Some experience in dry colors and pigments for research work. Young. $2400. Please reply to Box 102, The Chemist.

CHEMISTS

Bureau of Mines Expands Fact-Finding Activities in Field of Strategic Minerals

The inauguration of monthly canvasses on the production, consumption and stocks of strategic minerals commodities by the Bureau of Mines was announced recently by Harold L. Ickes, Secretary of the Interior.

This action was prompted by the need for current accurate data on certain domestic and imported raw materials to assist Government agencies as well as industry in meeting the various problems presented by the interruption to shipping, resulting from the European War. Secretary Ickes stated he had been advised by Dr. John W. Finch, Director of the Bureau of Mines, that manufacturers have on hand fairly large stocks of strategic minerals and that no immediate shortages are anticipated. Nevertheless, the fact-finding program was deemed imperative at this time because the situation required careful watching in view of the fact that acute shortages of mineral raw materials would be detrimental to the national defense and the public welfare.

He also pointed out that correct data on industrial mineral raw materials would be invaluable to private enterprise and urged the patriotic coöperation of business in this effort of the Bureau of Mines to render a timely and essential service.

At the annual outing of the Pennsylvania Chapter, held at the Oak Terrace Country Club on June tenth, lapel buttons of the AMERICAN INSTITUTE OF CHEMISTS were presented to Dr. Gilbert E. Seil and Dr. George R. Bancroft in recognition of their outstanding service to the INSTITUTE.

The American Section of the Society of Chemical Industry announces the election of the following officers for the year 1939-40: Chairman, Wallace P. Cohoe, F.A.I.C.; Vice-Chairman, Lincoln T. Work; Honorary Secretary, Cyril S. Kimball; Honorary Treasurer, J. W. H. Randall, F.A.I.C.

The following new Committee members were elected to take the place of retiring members: L. W. Bass, F.A.I.C., J. V. N. Dorr, C. R. Downs, F.A.I.C., J. C. Hostetter, F.A.I.C., and E. P. Stevenson.

National Farm Chemurgic Council

The National Farm Chemurgic Council has recently outlined its progress on a plan to return prosperity to the farmer, and thus to improve and stabilize social and economic conditions. Its officers are Mr. Wheeler McMillen, president; Mr. Louis J. Taber, vice-president; Dr. Roger Adams, vice-president; Dr. William J. Hale, secretary; Mr. John S. Haggerty, assistant treasurer. Its research staff is headed by Dr. Harry E. Barnard, F.A.I.C., director of research. Dr. Leo M. Christensen, F.A.I.C., is associate research director. Dr. Barnard is also editor of the *Farm Chemurgic Journal*. The Council is non-political and non-partisan, and has as its objective the enlargement of national farm income, and the creation and expansion of markets for American farm products as industrial raw materials. Since the farm is the primary source of America's raw material wealth, a growing volume of materials moved into the channels of manufacture and commerce will stimulate general employment. The demand of the farmers constantly facing overproduction

and consequent low prices is for new and expanding markets. The Chemurgic Council aims "to advance the industrial use of American farm products through applied science".

This organization was created at a conference at Dearborn, Michigan, May 5 1935. Its program was designed to:

1. Expand the knowledge of possibilities for research to increase farm income and national wealth.

2. To serve as a clearing house for all chemurgic information.

3. To direct the attention of private and industrial laboratories to chemurgic projects and to create popular support in behalf of research in public laboratories and educational institutions.

4. To encourage the commercial application of chemurgic research accomplishments whenever ready for profitable use.

5. To discourage unsound promotions.

6. To finance, in some instances, desirable research projects which neither public nor private laboratories are in position to undertake.

7. To aid and coöperate with other agencies employed with allied efforts.

In practical action the field of chemurgy may be said to embrace:

New uses for surplus farm products.

New crops to supply existing or new needs.

Profitable uses for farm by-products and wastes.

And by inference, a philosophy of creating more wealth by increase of scientific knowledge of nature's materials.

At the present time, the farm products of forty million acres are now used by chemurgic manufacturers. The Council believes that within ten years, through research and applied science, the productive capacity of fifty million additional acres can be required to meet the demands for industrial farm crops. The rapid advance in chemurgy is evidenced by the expansion of the huge paper manufacturing industry in the South, and the new interest which is being taken in research in all spheres of agriculture and science.

Specific fields in which chemurgic research and enterprise have provided new markets for products of the soil, or in which present scientific knowledge appears to indicate promise, are numerous. A few may be mentioned:

SOYBEANS, perhaps the best publicized to date. With scores of actual and potential industrial uses, this crop, little known twenty-five years ago, in 1938 reached a production of fifty-seven million bushels.

SWEET POTATOES, grown for starch. Commercial operation in Mississippi indicates a profitable crop, yielding exceptionally high quality starch and by-products. Near a half billion pounds of starch have been imported annually.

NEW COTTON USES, such as in road building, and in cellulose industries.

DRYING OILS, now largely imported, and an essential material in numerous industrial processes. Tung oil (also known as China-wood oil) is now grown commercially on the Gulf coast. Experiments with other oil seeds are under way.

CASTOR OIL, produced from the castor bean, processed by dehydration into a drying oil, and also highly regarded by chemists for numerous other requirements. Current research is also studying the fiber and insecticidal values of the plant.

WOODPULP from Southern pines. Recent years have seen this industry expand by more than $150,000,000, and the first southern newsprint mill is now being launched at Lufkin, Texas.

PLASTICS, into which several farm products go commercially or experimentally.

AGRICULTURAL ALCOHOL, for motor fuel, solvents, and numerous purposes. An official report of the Department of Agriculture (December, 1938) shows that agricultural alcohol, if nationally used in a 10 per cent blend motor fuel, would require expansion of acreage, and recommends further research immediately.

PYRETHRUM, as a base for insecticides. Now grown successfully in parts of the United States, this plant may replace thirteen million pounds of annual imports.

FIBER CROPS, to supply domestic needs for hemp, flax, jute, carpet wools and others.

The National Farm Chemurgic Council does not maintain its own laboratories, but endeavors to activate research through the helpful coöperation of existing facilities. These have included Universities and Land Grant Colleges, Agricultural Experiment Stations, Departments of Agriculture and Commerce, along with private and industrial laboratories.

Partly as a result of public interest created by the Council's educational activities, a number of these agencies have been enabled to enlarge their research activities.

A notable achievement are the four new regional laboratories, created by the 1938 Farm Act, where the Department of Agriculture will seek new uses for farm surpluses. This is the first major attack on surpluses by government research. The Council is now urging further research to establish new crops for new or old uses but which may occupy enough acreage to prevent surpluses.

Michigan State College recently received a $500,000 trust endowment fund for specific research in seeking new uses for farm crops, which was a definite outgrowth of the Chemurgic Council's educational work. A soybean laboratory has been established by the federal government at the University of Illinois. Several states have lately expanded facilities for chemical research in farm product fields.

In its program of education and public interest, the Council coöperates in regional or state chemurgic conferences with representatives and speakers attending from the three fields of agriculture, industry, and science. It is at these sessions that many of the vital and profitable research problems are first introduced, then followed by private or public support and developed to new uses for agricultural products in industry.

The National Farm Chemurgic Council now depends upon its membership for its entire financial support. For the first two years the work was financed entirely by The Chemical Foundation, Inc. This was in keeping with the great vision of the late Francis P. Garvan who was among the first to see what the Chemurgic program could contribute to the upbuilding of America.

In its program to help farmers to secure new markets, The Chemical Foundation has contributed more than $850,000 to chemurgic research projects and educational work. These activities include formation of National Farm Chemurgic Council and direct research in tung oil, paper from southern pines, power alcohol, cellulose, hemp, sweet potatoes and soybeans.

The National Farm Chemurgic Council entertains the hope that its activities will:

Result in the gradual absorption of much of the domestic farm surplus by domestic industry; put idle acres to

work profitably; increase the purchasing power of the farmer and thus create new demand for manufactured goods and provide more jobs in industry, enlarge the real wealth and well-being of the people, and expand the national income.

The Chemical Industry Medal of the Society of Chemical Industry will be presented to Dr. Robert E. Wilson, president of Pan American Petroleum and Transport Company, at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society on November 10, 1939, with Dr. Wallace P. Cohoe, F.A.I.C., presiding. The medal is awarded annually for valuable application of chemical research to industry and will be given this year to Dr. Wilson in recognition of his research studies on such varied subjects as flow of fluids, oiliness, corrosion, motor fuel volatility, clay and glue plasticity, and humidity; and in recognition of his industrial contributions in the use of tetraethyl lead, petroleum hydrocarbon cracking, and adoption of chemical engineering principles by the oil industry.

The meeting will be held at The Chemists' Club, 52 East 41st Street, New York, N. Y.

Foster Dee Snell spoke at the Chemical and Allied Industries' luncheon of The New York Credit Men's Association held at the Aldine Club on June eighth, on the subject, "Chemistry at the World's Fair". He discussed the rôle of Chemistry not only in many exhibits but in the buildings themselves, lighting, etc., which points to the fact that chemistry will play an important part in the world of tomorrow.

Henry G. Knight, F.A.I.C., chief of the Bureau of Agricultural Chemistry and Engineering, recently announced the following appointments to the staffs of the regional research laboratories:

Dr. M. J. Copley, as chief of the Analytical and Physical Chemistry Division, Eastern Regional Research Laboratory, Wyndmoor, Pennsylvania, who will direct research on the application of physico-chemical methods to aid in the development of new uses of surplus agricultural commodities;

Dr. Morris J. Blish, as chief of the Protein Division at the Western Regional Research Laboratory, Albany, California, who will direct research toward the development of new industrial uses for the proteins of wheat, alfalfa, seeds and kernels;

Dr. Howard D. Lightbody as principal biochemist to head the division of biochemistry in the Western Regional Research Laboratory, Albany, California, who will investigate problems related to the preparation of biologically active substances and the development of biochemical methods useful in the processing and storage of farm commodities;

Dr. Elbert C. Lathrop as head of the work on the industrial utilization of agricultural wastes at the Northern Regional Research Laboratory, who will develop new and improved methods for the production of cellulose products from such materials as stalks, straw, hulls, and cobs.

This year's Chemical Industries Exposition will be the largest since 1930, according to indications based on the amount of space now under contract to exhibitors. The Seventeenth Exposition of Chemical Industries will be held at Grand Central Palace, New York, during the week of December 4 to 9,

1939. Three entire floors of the Palace have been reserved and about ninety-five per cent of the total exhibit space is now engaged by exhibitors. Nearly 300 exhibitors representing over forty industries have engaged space. Chemicals, chemical raw materials, and fabricated materials for use in many industrial operations will be featured in terms of their manufacture and use.

The cornerstone of the Eastern Regional Research Laboratory of the U. S. Department of Agriculture at Wyndmoor, Pennsylvania, was laid on the afternoon of October twentieth. Leaders in agricultural and industrial research and many interested in industrial developments in the region attended. Principal speakers on the program were Senator Joseph F. Guffey and Under Secretary of Agriculture, M. L. Wilson.

The U-shaped laboratory building, including the 211-foot base of the U and nine bays of the laboratory wing had reached the third floor stage at the time of the cornerstone ceremony. They will be finished and ready for installation of equipment by June 15th. The laboratory's research projects in the beginning will be directed toward developing wider industrial outlets for potatoes, tobacco, milk products, apples, and vegetables.

INSTITUTE members who participated in the Army War manoeuvers at Plattsburg, New York, this summer included Captain Joseph F. Padlon, F.A.I.C., and Lieutenant Louis Marshall, F.A.I.C.

BOOKS

DIE ELEKTRISCHEN GRUPPEN IN BIOLOGIE UND MEDIZIN. By Rudolf Keller. 92 pages (9 pages of English summary). *Sperber-Verlag*. Zurich.

The ideas expressed by the American, Jacques Loeb (1900) when he discovered the so-called "ionantagonism" theory are contained in this book which reviews findings concerning electric groups as related to medicine and biology. The author says in conclusion that in all plants and in most of the lower animals electricity is the dominating force of differentiation. "The future biochemist has only to accept the real groups of organic and inorganic substances and his results will be also electrical, even if he never touches a voltmeter, or whether or not he accepts the new experimental order as biologically positive and negative material." This sounds like Loeb's proclamations, but it seems that Keller and his collaborators have a better foundation for their work. If so, the future will not know Keller as another "ionantagonist", but as a man who showed new paths in medicine and biochemistry.

—Rudolf Seiden

EINFÜHRUNG IN DIE KERNPHYSIK. By Wolfgang Riezler. *Bibliographisches Institut,* Leipzig. 188 pages.

A German research worker successfully explains the newest findings in the field of atomic-physics.

—Rudolf Seiden

INTRODUCTION TO ORGANIC COMPOUNDS, EXPERIMENTS AND DEMONSTRATIONS. Nicholas D. Cheronis, Chicago City Colleges, Chicago, Illinois. Published by the author in 1936, revised in 1938. 2+212 pp. 21x27 cm. $1.50.

"The manual was designed to serve as an introduction to the compounds of carbon, based upon one semester's work. The laboratory work outlined involves one hundred hours of actual laboratory practice divided into two three-hour periods for seventeen weeks."

An attempt is made, according to the author, to avoid "mere cook-book experiments in which the sole object is to attempt one preparation after another." Instead, the compounds of carbon are arranged into groups which show closely related chemical properties. In each group, one or two syntheses serves to illustrate the general methods of preparation for that homologous series. Following the illustrative syntheses, a systematic study is made by use of test tube experiments "to show both the general properties or reactions and differences in reactivity."

One of the unique features of the manual is the "provision for demonstration experiments performed by the instructor once per week during the regular laboratory period." These demonstrations are intended to supplement rather than to replace the work of the student in the laboratory. The demonstration experiments include the aldol condensation, numerous applications of the Grignard reagent, exercises in optical measurements, and other technics that have proved to be advantageous in clarifying what otherwise would have given the student only "blackboard knowledge of the procedure." It is thus possible to acquaint the student with technics and apparatus that are otherwise beyond the realm of undergraduate instruction.

The introduction includes general information, a discussion of general laboratory procedure, precautions for the prevention of accidents, and a colorimeter pH comparator chart.

The experiments included in the manual are: the sources of organic compounds, the purification of organic compounds by crystallization; the determination of melting point; purification by distillation; micro-determination of the boiling point; identification of elements in carbon compounds; the molecular-structure of organic compounds; the preparation of hydrocarbons by use of the Grignard reagent; preparation of hydrocarbons by the union of two radicals; preparation of hydrocarbons by elimination of the carboxyl group; the study of unsaturated hydrocarbons; the preparation of acetylene; the study of benzene; the reactions of hydrocarbons; the study of monohalogen compounds; the preparation of *n*-butyl bromide; the properties and reactions of halogen compounds; the preparation of alcohols by the Grignard reagent; the reactions of hydroxy compounds; the preparation of diethyl ether; the preparation of amines; the reactions of amines; the oxidation of alcohols to aldehydes and ketones; the reduction of carboxyl to carbonyl; preparation of acetaldehyde by depolymerization; reactions of aldehydes and ketones; the polyhalogen compounds; the preparation of carboxylic acids; reactions of carboxylic acids; preparation and properties of esters; preparation and properties of acyl chlorides; preparation and properties of amides; the polyhydric alcohols; the properties of carbohydrates, optical activity; the study of amino acids; the proteins; the preparation of diazonium compounds; replacement of the diazo group; the union of diazonium salts

with aryl amino and hydroxy compounds, identification of an organic compound, and four experiments illustrating the use of semimicro technic in elementary organic chemistry.

The general plan of the manual provides for (a) a theoretical discussion immediately preceding each experiment, (b) the experimental procedure, and (c) the fill-in type of detachable report sheets.

The manual is bulky as it is still in the mimeograph stage, but the workmanship is fairly satisfactory for a book of this type. It offers an approach to the teaching of organic chemistry that is in keeping with the general trend toward supplementing regular laboratory work with regular lecture demonstrations.

—Ed. F. Degering, F.A.I.C.

EMPLOYMENT

Chemists Available

Physical Chemist, F.A.I.C., with industrial experience in electronics and fluorescent materials. Three years' teaching experience during depression. Fairly at home in the French language. Ph.D., Cornell, 1928. Report of Stevens Human Engineering Laboratory available. Location in metropolitan New York desired. Employed but looking for broader job. Please reply to Box 91, The Chemist.

Chemist, 42, Ph.C., F. A. I. C., American born, experience in chemical and pharmaceutical products, foods, specialities, etc. Able to handle analytical, research, production cost and supervision. Miscellaneous pharmaceutical compounding, medicinal and chemical preparations, a specialty. Writer is known for technical publications in the U. S. and abroad. Out of position on account of abandonment of plant with which he had been affiliated for past ten years. Excellent references. Please reply to Box 53, The Chemist.

Organic Chemist. B.A. degree. Age 26. Graduate experience Columbia University in Synthetic Organic Chemistry. One year New York University Organic research. Knowledge of X-rays. Please reply to Box 51, The Chemist.

Organic Development Chemist, B.S., A.A.I.C. Age 35 Eleven years' of practical laboratory and plant experience with a large manufacturer of dyestuffs. Desires employment with an organization in the consulting field. Please reply to Box 41, The Chemist.

Chemist, Ph.D., F.A.I.C., seeks position in industrial research or teaching, Major field organic. Eleven years' experience teaching organic, analytical and advanced inorganic in university. Some direction of research and consulting work. Age 33, married. Phi Beta Kappa, Sigma Xi, Phi Lambda Upsilon. Please reply to Box 51, The Chemist.

Young Woman. Secretary, stenographer. Christian. B.S. in chemistry, with biology minor. Eight years secretarial experience. Excellent French. Prefers chemical or biological firm. Please reply: Box 101. The Chemist.